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EXAMINER	
SCOTT JR, LEON	
ART UNIT	PAPER NUMBER
2828	

DATE MAILED: 06/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No.	Applicant(s)
	09/814,464	DAIBER, ANDREW
	Examiner	Art Unit
	Leon Scott, Jr.	2828

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on ______ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10,12-19 and 21-60* is/are pending in the application.

4a) Of the above claim(s) ______ is/are withdrawn from consideration.

5)☐ Claim(s) ______ is/are allowed.

6)☒ Claim(s) *1-60* is/are rejected.

7)☐ Claim(s) ______ is/are objected to.

8)☐ Claim(s) ______ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 April 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on ______ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. ______ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *6&7* .
4) ☐ Interview Summary (PTO-413) Paper No(s). ______ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

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The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-10,12-19 and 21-60 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In line 2 of claims 1,7 and 16 no structure has been recited which is capable of producing a coherent light beam; claims 1,7 and 16 are indefinite and incomplete. It is not clear in line 3 of claim 1 what is being tuned by the tuning element; further it is not clear how the tuning element functions in the device as a whole; claim 1 is indefinite and incomplete. In: line 4 of claim 1, line 5 of claim 7 and line 7 of claim 16; since the function of a detector is to detect, it is not clear what is being detected; claims 1,7 and 16 are indefinite and incomplete. Further it is not clear in claims 1,7 and 16 how the detector, which detects, generates an error signal; claims 1,7 and 16 are indefinite and incomplete. Further in: line 5 of claim 1, in lines 6 of claim 7, and in line 7 of claim 25; it is not clear how the error signal is indicative of a characteristic, what characteristic? and how is it *associated with* the tuning element; claims 1,7 and 25 are indefinite and incomplete. In line 3 of claim 5 the recitation *said error signal is indicative of spatial losses* expresses a desired result since it is not clear that merely inferring positioning of the constructive interference fringe in said light beam will produ e spatial losses In line 3 of claim 2 and in line 8-10 of claim 7, it is not clear how the tuning assembly tun s

the tuning elem nt a cording to said error signal; claims 2 and 7 are indefinite and incomplete. Since nothing has been recited to associate the characteristic with the position of the tunable element claim 3 it is indefinite and incomplete. Claim 3 is confusing. In claim 4 it is not clear of what import is the positional adjustment of the tunable element in the coherent light beam, further how is this adjustment accomplished according to the error signal; claim 4 is indefinite and incomplete. It is not clear in lines 1 and 2 of claim 5 and in lines 4 and 5 of claim 16 how the tunable element <u>defines</u> a constructive interference fringe; claims 5 and 16 are indefinite and incomplete. In line 2 of claims 7 and 16 what produces the <u>fixed</u> wavelength claims 7 and 16 are indefinite and incomplete. In line 9 of claim 7 it is not clear how the tuning <u>assembly</u> is <u>configured</u> to tune said tunable element, is it not the tunable element which tunes? ;claim 7 is indefinite and incomplete. In line 1 of claims 8,9,18,19 and 21-23, it is not clear what *<u>servo system</u>* is being claimed, no antecedent basis exist for such a system; claims 8,9,18,19 and 21-23 are indefinite and incomplete. The recitation The system in line 1 of claim 10 and 12-14 lacks a clear antecedent basis. It is not clear within the context of claim language in claims 13 and 22 what constitutes a MEMS device; claims 13 and 22 are indefinite and incomplete. In line 4 of claim 16 it is not clear within the context of claim language what the tunable element tunes; claim 16 is indefinite and incomplete. Further in lines 12 and 13 of claim 16 it is not clear how the tuning assembly is *<u>configured to adjust</u>* said constructive interference fringe; claim 16 is indefinite and incomplete. Claims 26-33 and 36-40 are not methods claims in that they do not recite method steps but rather recite structure, thus it is not clear what applicant is relying upon to carry the claim, method or apparatus?; claims 26-33 and 36-40 are indefinite and incomplete. It is not clear in lines 5 and 6 of claim 34 how the tunable element <u>defines</u> a constructive interference fringe; claim 34 is indefinite end incomplete. In line 9 of claim34 it is not clear how an error signal is generated from the dete tor; claim 34 is ind finite and incomplete. Further how is the error signal

indicative of a position of the c nstru tive interference fringe; claim 34 is indefinite end incomple.e. In line 3 of claim 41 it is not clear how the tunable element defines a constructive interference fringe; claim 41 is indefinite and incomplete. In lines 6 and 7 of claim 41 and in lines 4 and 5 of claim 49, it is not clear how the tuning assembly, which is coupled to said detector, is configured to tune the tunable element; claims 41 and 49 are indefinite and incomplete. Further how is the tuning assembly coupled to the detector, optically or electrically; claims 41 and 49 are indefinite and incomplete. Claim 44 is an apparatus claim, claim 27 is a method claim ; claims 44 and 45 are *improperly dependent* from claim 27 in that it is not clear what applicant is relying upon to carry the claim; method or apparatus. In claim 46 it is not clear how the drive element tunes said tunable element according to an error signal; claim 46 is indefinite and incomplete. In line 2 of claim 49 it is not clear what structure produces the coherent light beam; claim 49 is indefinite and incomplete Since the preamble can not be used to positively recite elements of the claim; the recitation said external cavity laser in line 3 of claim 49 lacks a clear antecedent basis. In claim 50 it is not clear how the error signal from the detector assist in tuning the mirror of the external cavity laser; claim 50 is indefinite and incomplete. Claim 51 is an apparatus claim, claim 35 is a method claim, thus claims 51-53 are improperly dependent from claim 35. Further it is not clear in claim 51 what produces the third error signal; claim 51 is indefinite and incomplete. In claim 59 it is not clear how the oscillator element is associated with the drive element; claim 59 is indefinite and incomplete.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was d scribed in a patent granted on an application for patent by an ther filed in the United States before

the inventi n thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claims 1-4,7-9,11,13,18,19,21,22,25 and 49 are, insofar as definite, rejected under 35 U.S.C. *102(e)* as being *anticipated* by Green et al(U.S. 2002/0126345 A1)

Green et al disclose: a coherent light generator(224,900); a tunable element(290) positioned in said coherent light beam; and a detector positioned in said coherent light beam(920,922); FIG. 9 is a block diagram of an alternate embodiment of a vernier tuned filter as part of a wavelength locker and mounted on a tuning assembly(260,902, see fig. 2A and fig. 9) coupled to said tunable element and said detector to tune said tuning element according to an error signal. An optical beam source(900) is shown emitting an output beam(904), that beam may include a number of channels each centered on a corresponding gridline of a selected wavelength grid. That beam passes through a beam splitter(910) to generate an output beam(906) and a reference beam(908). The reference beam passes through a first photodetector(920) and a second photodetector(922). Between the first and second photodetectors is positioned the vernier tuned filter generally(290). That filter is tuned to a selected wavelength to measure one or more of the output wavelengths of the beam. The drift of the output wavelength of the laser is measured at the second photodetector(922). Differencer(924) accepts as inputs the signal provided by the photodetectors(920 & 922). The photodetectors in combination with the differencer comprise an *error detector* to detect a difference in energy levels of the beam at the input and output of the vernier tuned filter and to provide an output in the form of an *error signal* . The error signal, may be subject to amplification in amplifier(926) and is supplied to the laser(900) and to logic th rein (not shown) for adjusting a wavelength *control parameter* of th las r, e.g. drive current. In an emb diment of the invention, wh r th control parameter is

current, the output of the amplifier may be coupled to l gic which includes a summer, which sums the *error signal* and a laser drive signal to drive the laser . Green et al further discloses that the tuning assembly is configured to positionally adjust(see: fig 2, 252 and 256(translate along beam axis) and fig. 3A ,318(translate perpendicular to beam axis)) the tunable element(290). In an embodiment of the invention t the control variable is temperature. In alternate embodiments of the invention the control variable(s) include: position, rotation, temperature, electrical parameters, electro-optic parameters etc. The pass band characteristics of either or both the channel selector and the grid generator are correlated with a specific control variable, e.g. tuning parameter, appropriate for the manner in which selector/generator is being tuned/regulated. Tuning/regulation may be accomplished by mechanical, electrical or opto-electrical tuning devices. Mechanical parameters include positions of the channel selector, (See FIG. 3A). Electrical parameters include current, voltage, capacitance, and inductance. Opto-electric parameters include index of refraction and birefringence. The parameters may be input for a group of similar devices or may be individually calibrated .

Claims 1-5,7-9,12,16,25-29,31,34-38,41,45,49 and 52 are, insofar as definite rejected under 35 U.S.C. *102(e)* as being *anticipated* by Zorabedian(U.S. 6,108,355).

Zorabedian discloses: a corrective element(120) fabricated from an optical element having a uniform index of refraction. The corrective element has a *wedge-shaped* profile with exterior and interior generally planar surfaces which converge at a corrective angle(202); both the corrective element(120) and the air gap etalon(162) are coupled to a mount(142), which is in turn coupled to translator (144). The translator(144) is affixed to the base(138) (see FIG. 1A). The translator is coupled to and controlled by the tuner(160). The tuner may include fe dback elements, such as sensors, to m nitor laser operating parameters, e.g. wavelength of the laser. Further the translator may be a piezo-electric element,

the tun r would provide the electrical impulse to control the expansion and contraction of the piezo-electric lement along the translation axis(190). This would have the effect of translating both the air-gap etalon and the corrective element synchronously across the optical axis. In FIG. 2A, the combined etalon and corrective element assembly is shown at a retracted position(204) and an extended position(206), linearly displaced from one another along the translation axis(190). FIG. 2B provides an exploded cross-sectional view of the paths 224-226 and 220-222 of the beam(124) at each of these positions through both the air-gap etalon162) and the corrective element(120). In the retracted position(204) the beam traverses relatively thicker portions(224-226) of respectively the air-gap etalon and the corrective element. In the extended position(206) the beam traverses relatively thinner portions(220-222) of respectively the air-gap etalon and the corrective element. Thus, in the extended position of the etalon and corrective element, the etalon supports shorter wavelengths at which *constructive interference* takes place between the reflective surfaces of the etalon or higher frequencies of lasing. In the retracted position, the etalon supports longer wavelengths and lower frequencies of lasing at which *constructive interference* takes place. Absent the corrective element(120), the translational tuning of the air-gap etalon would result in mode-hopping since both the optical and actual length of the external cavity would be constant. In the embodiment shown in FIG. 2A, the corrective element(120) is a material fabricated from a substrate with a uniform index of refraction which varies in thickness and is affixed to and actuated by the same translator(144) which positions the etalon(162). Thus, the translation of the corrective element(120) provides a variation in the average index of refraction of the optical path. By synchronizing the etalon and corrective element, the average index of refraction along the beam path varies directly with the tun d wavelength thus maintaining the same integer number of half-wavelengths in the external cavity. In addition to th m chanisms for providing cavity tuning by etalon translation and

optical path correction, the emb diment of the inventi n shown in FIGS. 1-2 als diminishes the am unt of spuri us reflecti ns(214) which are fed back into the laser amplifier(102). Because of the narrow wedge (tuning) angle between the reflectors, the beam intersects each of the reflectors substantially orthogonally. This results in out-of-band, unfiltered spurious reflections and spurious interference being fed back directly to the gain medium (see FIG. 2 reference 214, 210). This unwanted feedback is detrimental to the operation of the laser .The quarter-wave plates(112-114) reduce the feedback from spurious reflections(214). The filter/etalon(162) operates in double-pass transmission for feeding back narrow band light to the gain medium. A high finesse interference filter/etalon has sharp transmission peaks and light which is not transmitted by the filter/etalon(162) is reflected back toward the gain medium. Since the gain medium preferentially amplifies substantially linearly polarized light, along with the polarization transforming properties of quarter-wave plates, the filtered light passes twice through both quarter-wave plate(112) and quarter-wave plate(114) and thus returns to the gain medium with the same polarization as it started with. The reflected light(214) passes twice through only quarter-wave plate(112) and thus returns to the gain medium with the orthogonal polarization it started with and thus is not amplified by the gain medium. FIGS. 2C-D show alternate embodiments of the etalon and corrective element which retain the translational tuning feature, as well as suppression of both mode-hopping and spurious reflections. In the first of these embodiments shown in FIG. 2C, the second reflector of the air-gap etalon is affixed directly to the interior face of the quarter-wave plate(122) and the retroreflector(122) has been affixed directly to an exterior face of the quarter-wave plate(122). The entire assembly including the associated wedge shaped corrective element(120) is coupled via mount(142) and translator(144) to base(138) (not shown). These components are moved by th translator al ng th translati n axis(190) (see FIG. 2A) with the same effects in terms of tuning and adjustment f the index of refraction of the external cavity to maintain an integer

number of wavelength in the cavity as described in c nnection with FIG. 2A. Additionally, the quarter-wave plates have a similar effect of suppressing spurious reflection of the beam from the first reflector(116). FIG. 2E shows an alternate embodiment of the invention in which both the corrective element and the first reflector(116) of the etalon are stationary. In this embodiment, *only* the *assembly* comprising the second reflector(118) of the etalon, the quarter-wave plate(144) and the retroreflector(122), are subject to translation along the translation axis(190)(see FIG. 2A) by means of the translator(144). The opposing first and second reflectors(116-118) maintain similar angular relationship, i.e., tuning angle(200), to that described in connection with FIGS. 2A-D. The second reflector(118) is a generally planar surface intersected by the optical axis(100). The translation of the second reflector(118) along the translation axis results in a variation of the thickness of the air gap between the reflectors relative to the optical axis which allows for tuning of the external cavity. Additionally, the corrective element(240) is fixed. In this embodiment the corrective element is fabricated from a material in which the refractive index can be varied by means of an *electrical stimulus provided by a mode controller(*260). The *mode controller* is coupled both to the corrective element(240) and to the tuner(160). The tuner extends and retracts the second reflector(116) of the etalon to increase or decrease the frequency of the external cavity laser. Concurrently, the mode controller applies the appropriate electrical energy to the corrective element(240) so as to increase or decrease the refractive index of the element to vary the optical path length of the cavity and thereby suppress mode-hopping during tuning of the laser . If the cavity length remains constant as the filter/etalon peak is tuned, the laser output will change discontinuously, giving rise to a tuning characteristic known as mode-hop tuning (see FIG. 3A). As shown in FIG. 3A, the tuning of a cavity without a corrective el ment involves a change in wavelength and in the integer number of half-wavelengths in the tuning cavity over the entire operating range.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1,6,7,15,16,18,24,25-29,31,34-36,38 and 40-60 are, insofar as definite rejected under 35 U.S.C. 103(a) as being unpatentable over Green et al and Zorabedian, both as applied above, and further in view of Danielmeyer(3,676,799).

Danielmeyer('799) discloses: single frequency laser oscillation by including within the laser cavity a resonant etalon, tuned to the desired laser frequency. This has the effect of suppressing all other modes while permitting the laser to oscillate at the desired single frequency. In addition, the etalon tuning is frequency modulated about the desired frequency, producing an amplitude modulation of the laser signal. The amplitude modulation thus produced is sensed by a phase detector which generates an *error signal* whenever the laser frequency tends to deviate from the mean, etalon frequency. The error signal is used, in turn, to retune the laser cavity.

As to the drive element, and/or drive current controller in claims 46,47, 51 and 56-59; it is clear that the refractive index can be varied by means of an *electrical* stimulus provided by a mode controller(260; see col. 2 lines 40-52 of Zorabedian), thus the drive element and/or drive current are *inherent* in the reference combinati n. As to the second error signal and second tuning assembly of the claims, given the disclosure of one error signal and/or one tuning assembly; produ ing two or m re of such

elements or devices would be obvi us. Given the teachings of the reference to Danielmeyer('799), and since the reference is concerned with using etalons to tune the laser, it would be obvious that one of ordinary skill in the art desiring to amplitude modulate the laser would be motivated to use the oscillator element of Danielmeyer('799) and the reference combination drive element in a second tuning assembly, if desired. Applicants' device is obvious. As to the split detector in claims 6,15,24,22,33,40,48,50,58 and 60; given the detectors of the reference (see fig. 9 of Green et al) and since one detector can be substituted for another depending upon the desired result or intended use; it would be obvious that one of ordinary skill in the art desiring to compare a portion of the beam that passes through a second and/or third gain medium with the incident beam would, if desired be motivated to use a split detector. As to the difference signal of claims 33 and 40, this reads on element 924 in fig.9 of Green et al.. Since each of the references of the combination is concerned with etalon tuning, it would be obvious that one of ordinary skill in the art desiring to use error signals and/or constructive interference to tune an external cavity laser would be motivated to incorporate the teachings of Green et al in a device built around the teachings of Zorabedian, to achieve the desired tuning result, applicants device is obvious.

McDonald et al(2002/0172239) is cited for its teaching of a tunable external cavity laser

Zorabedian et al(U.S. 6,282,215) is cited for its teaching of a continuously tunable external cavity laser.

Danielmeyer(U.S, 3,628,173) is cited for its teaching of laser mode selection and stabilization using a birefringent etalon.

Any inquiry concerning this c mmunicati n r earlier communications from the examiner should be directed to Le n S ott, Jr. whose telephone number is 703-308-4884. The

examiner can n rmally be reach d on Monday - Friday, 6:30am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul P. Ip can be reached on (703)308-3098. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7721 for regular communications and 703-308-2864 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-3431.

Leon Scott, Jr.
Primary Examiner

Leon Scott, Jr.
Primary Examiner
Art Unit 2828

lsjr
May 31, 2003